Geophysical Research Abstracts
Vol. 21, EGU2019-4346, 2019
EGU General Assembly 2019

Application of a Machine Learning Approach for Cloud Microphysics Processes

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Machine Learning (ML) approaches permeate all aspects of fields, such as drug discovery, e-commerce websites, and spam e-mail filtering (Lecun et al. 2015). It has rapidly improved the accuracy and generality of the algorithms. The ML-based frameworks require inexpensive computing resources to predict a specific property and represent complex processes. Increasingly, the ML approaches offer an attractive possibility to understand the non-linear stochastic phenomenon.
Here, we apply an ML approach to earth system modeling in particular cloud micro properties. Today, in addition to the traditional Eulerian approaches, the particle-based Lagrangian methodology has experienced growing popularity for understanding clouds' physical processes. The motivation of the model is that it does not need any parameterizations while solving fundamental equations. The methodology has improved the state-of-the-art in the field of cloud microphysics with the help of exponential growth in computational power. Despite their growing popularity, however, it is still too expensive to fully convert the large-scale prediction system.
In this study, we develop an efficient ML approach that enables spatially and temporally resolved insight into cloud microphysical properties. The framework presented here utilized another concept for the cloud microphysics properties while maintaining the full flexibility of a complicated data-driven ML method. In this talk, I will outline the advantage of the new framework is that it can serve as small-scale variability without considerable efforts to directly solve small-scale processes. Therefore, the framework can help to reduce computational efforts by following natural cloud microphysics. Also, I will present the comparison results with a cloud model.